
Shot Data Analysis Group

Responsibilities

- Shot Data
 - Responsible for physics analysis of shot data
 - Oversees the development of shot data analysis tools
 - Responsible for the integrity of shot data
- Operational Model
 - Responsible for the operational model of the accelerator complex
 - Develops guidelines for shot strategy based on SDA data
- Shares responsibility for handling unusual operational situations

Jean Slaughter -Feb 24, 2004

Organization

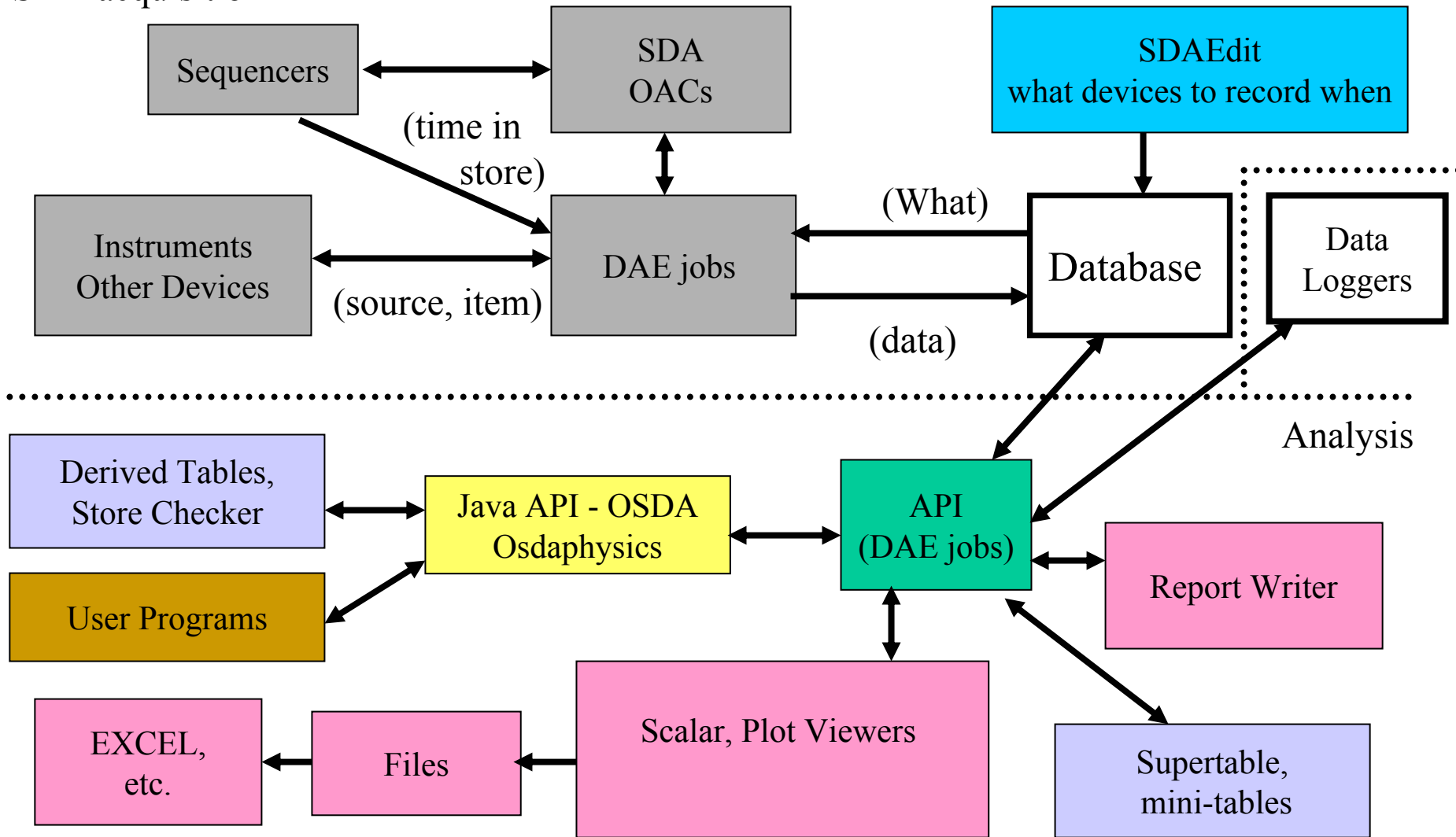
- SDA group in Integration Department
 - K. Gounder, E. McCrory, V. Papadimitriou, J. Slaughter
 - Phenomenological Model
 - Elliott McCrory
 - Mentioned in plenary talk
- Controls Department
 - T. Bolshakov, M. McCusker, K. Cahill, B. Hendricks, J. Patrick and others
 - Infrastructure and applications
- Computing Division
 - K. Genser, P. Lebrun, S. Panacek
 - Analysis and applications

Two Aspects of Shot Data Analysis

- Acquiring and archiving the data
 - "stores" are
 - HEP stores - (Pbar and/or Recycler) + Tev
 - Transfers among Accumulator, MI, Recycler in various combinations
 - SDA - sequenced data acquisition - main source of information
 - sequencer driven processes that collect a defined set of information from multiple sources at specific times during a "store".
 - Data loggers
 - Not "store" oriented
- Analyzing the data
 - Standard tables and plots built automatically
 - Browsers
 - Special purpose studies

Data Acquisition and Analysis Tools Diagram

SDA acquisition



Coordination of Shot Data Analysis

- Inputs - are we saving all the the relevant information?
- Inputs - is the instrumentation working and understood?
- Is data acquisition reliable?
 - Adequate for current load
- Do we have adequate tools for using the data?
 - Operations
 - Special studies

Inputs to SDA

- Intensities
- Beam sigmas and transverse emittances
- Bunch lengths and longitudinal emittances
- BPM orbits
- Luminosities, losses, beam positions from CDF/DO
- Magnet settings, readbacks
- Misc. devices like RF control signals
- Fast Time plots of intensity devices and control settings
- Tevatron tunes
- Beams Division Documents 691, 692, 703, 705
- Never ending task to keep on top of this

Instrumentation

- “Garbage in - garbage out”
- Relative calibrations between devices
 - DCCTs versus wall monitors versus fast bunch integrators for intensity
 - Flying wires versus synchrotron light
- Calibration between different machines
 - Bunch length in MI versus bunch length in Tevatron
- Systematic and statistical errors
- Day to day monitoring - did something break?

Instrumentation - II

- Interpretation of measurements
 - Measure transverse and longitudinal beam sizes
 - Conversion to emittances and dp/p is non-trivial
 - Coupled machine
 - Knowledge of lattice
- Instrumentation/beam physics working group
 - Transverse emittances and longitudinal emittances
 - Tune measurements
 - Intensities and efficiencies
 - People from systems and instrumentation departments, beam physics group in the integration department

Analysis Tools

- Browser and Report Writer for quick studies
- Tables built automatically every store
 - Supertable and EXCEL package
 - Derived tables and associated plotting tools
 - Short summary tables
 - Tables use corrected values
- Shots scrapbook
- OSDA (Offline Shot Data Analysis) - Suite of Java classes for user programs to directly access the data, apply corrections and calculate generally useful quantities like lifetimes

Supertable

- One line per store
- Built automatically every store
- 130+ quantities of general interest
 - Dates, time on helix, length of store, how store ended
 - Luminosities, intensities, lifetimes, efficiencies, emittances at various steps in store
- Web Accessible - HTML, EXCEL
 - analysis with plots, tables also on Web
- Standard source of performance data

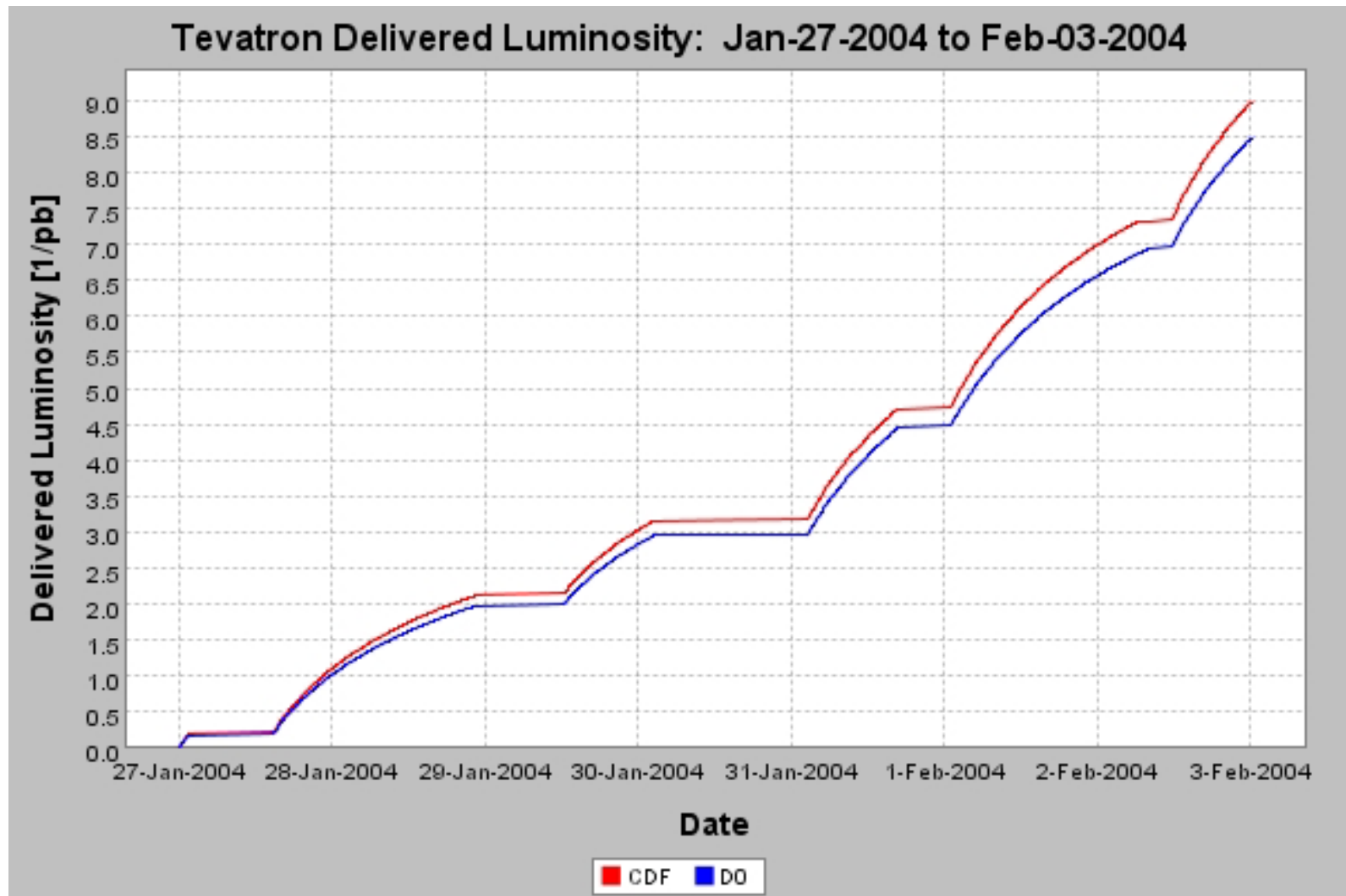
Edited Excerpt from Super Table

0 Store #	1 Date started shot set up	7 store length (hours)	8 how store ended	10 start stack	11 unstacking fraction	12 amount unstacked
3228	2/12/2004	0.22	Not Completed	135.19	0.88	119.2
3226	2/10/2004	33.31	Normal	160.39	0.86	138.6
3224	2/8/2004	36.92	Normal	149.39	0.87	129.6
3222	2/7/2004	40.18	Normal	177.19	0.81	144.2
3219	2/5/2004	31.09	Normal	173.79	0.85	147.6
3217	2/3/2004	27.98	Normal	204.19	0.8	163.4
3214	2/2/2004	33.89	Normal	208.19	0.75	156.4
3212	1/31/2004	31.37	Normal	175.19	0.78	136
3210	1/30/2004	14.65	Normal	189.39	0.62	118
3206	1/29/2004	15.1	TevQuench	80.59	0.94	75.4
3197	1/27/2004	32.38	Normal	120.39	0.9	108.6
3195	1/26/2004	2.68	Abort	145.39	0.91	131.6
3191	1/25/2004	17.9	Abort	103.79	0.93	96.2
3189	1/23/2004	35.76	Normal	142.39	0.88	125.2
3185	1/22/2004	26.41	Normal	133.19	0.9	120.4
3183	1/21/2004	23.59	Normal	120.39	0.85	102.6
3179	1/19/2004	27.76	Normal	163.19	0.86	140.4
3177	1/17/2004	22.27	Normal	172.39	0.81	140
3175	1/16/2004	25.07	Normal	176.39	0.7	123.6
3172	1/15/2004	21.48	Normal	159.99	0.51	81.2

Derived Tables- Bunch by Bunch Information

- Table per store - built automatically
 - All 6 emittances
 - Intensities
- Average and bunch by bunch information
- Use best algorithms to get physics quantities
 - Not always available directly from front-end.
- Interactive plotting interface

Integrated Luminosity Table



Monitoring SDA itself

- Complex system - lots of places for things to go wrong
 - Front ends - instrumentation, MADCs, break
 - DAQ process itself
 - Problems in the access to the data
 - Problems in the analysis code
 - Needs constant monitoring
 - Error logs from SDA Data Acquisition processes
 - Store checker
 - User complaints
 - Responsibility of SDA AID group
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Store Checker

- Purpose
 - Monitor instrumentation and DAQ
 - Monitor accelerator performance - soon
- Checks SDA data for specified cases/sets
 - $\text{Min} < \text{device value} < \text{max}$
 - $\text{Min} < (\text{difference in time of 2 devices}) < \text{max}$
 - $\text{Min} < (\text{difference in value of 2 devices}) < \text{max}$
- Jobs run automatically every store
- "Standard" and "private" lists
- Results on WWW for "standard" list
- Lists on WWW
- Used to give email notification of initial luminosities

Summary

- Basic SDA tools in place
- More sophisticated analysis will be needed as luminosities increase
- Continual job to keep the system going

- Operational model has provided much insight into optimizing integrated luminosity.
 - Tools, information can be applied to reliability analysis - E. McCrory's talk.

- Other activities
 - Liaison with experiments to use luminosity and interaction region data to optimize luminosity and understand machine performance